

Errata

As of June 2000, please note that the contact information for SmartSonic has changed to:

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Office of Research and Development

Washington D.C. 20460

**ENVIRONMENTAL TECHNOLOGY VERIFICATION STATEMENT**

TECHNOLOGY TYPE:	ULTRASONIC AQUEOUS CLEANING SYSTEMS
APPLICATION:	CLEANING PRINTED CIRCUIT BOARD STENCILS
TECHNOLOGY NAME:	SMART SONIC®
COMPANY:	SMART SONIC CORPORATION
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The U.S. Environmental Protection Agency has created a program to facilitate the deployment of innovative environmental technologies through performance verification and information dissemination. The goal of the Environmental Technology Verification (ETV) Program is to enhance environmental protection by substantially accelerating the acceptance and use of innovative, improved, and more cost-effective technologies. The ETV Program is intended to assist and inform those individuals in need of credible data for the design, distribution, permitting, and purchase of environmental technologies. This verification statement provides a summary of performance results for the Smart Sonic Aqueous Cleaning Systems, registered trademark **SMART SONIC®**.

PROGRAM OPERATION

The EPA's ETV Program, in partnership with recognized testing organizations, objectively and systematically documents the performance of commercial ready environmental technologies. Together, with the full participation of the technology developer, they develop plans, conduct tests, collect and analyze data, and report findings. Verifications are conducted according to a rigorous workplan and established protocols for quality assurance. Where existing data are used, the data must have been collected by independent sources using similar quality assurance protocols. EPA's ETV Program, through the National Risk Management Research Laboratory (NRMRL), has partnered with the California Department of Toxic Substances Control (DTSC) under an ETV Pilot Project to verify pollution prevention, recycling, and waste treatment technologies.

TECHNOLOGY DESCRIPTION

Smart Sonic Corporation developed the Model 2000 and Model 4200 ultrasonic aqueous cleaning systems to replace 1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113), 1,1,1-trichloroethane (1,1,1-TCA) and isopropyl alcohol (IPA) based systems used in the electronics industry to clean various types of solder pastes from printed circuit board stencils.

Smart Sonic's stencil cleaning technology consists of Smart Sonic's proprietary 440-R SMT Detergent®, ultrasonic generator and 40 kHz piezoelectric transducers, stainless steel wash tank, rinse tank (included in semi-automated system), and control devices.

The semi-automated Model 2000 system is approximately 3 feet high with a 40 x 44 inch base. This unit has a separate wash tank and a manual rinse station. The automated Model 4200 system is approximately 50 inches high with a 36 x 62 inch base. The pneumatic lift used on this model extends 36 inches for a total system height of 86 inches. This system has one tank for washing with an automated rinse over the wash tank.



The combination of Smart Sonic's 440-R SMT Detergent and ultrasonics enables the removal of solder pastes from printed circuit board stencils. Detergent surfactants act as wetting agents to saturate the solder paste layer that is left on the stencil surface (from solder paste printing operation). The ultrasonics then produce an intense scrubbing action, through cavitation and implosion of microscopic bubbles that enhances removal of the saturated solder paste layer. Ultrasonics are often more effective in cleaning hard-to-reach surfaces (i.e., small stencil apertures) than brushes and hand wipes. The cleaning bath is operated at room temperature, eliminating any potential effects to stencil from cleaning solutions requiring higher temperatures.

EVALUATION DESCRIPTION

Between May and September 1998, an evaluation of two ultrasonic aqueous cleaning systems, developed by the Smart Sonic Corporation, was conducted using field and laboratory qualitative and quantitative data. The aqueous cleaning systems include Smart Sonic's Model 2000 and Model 4200 systems. The objectives of this evaluation were to verify, through independent sources, the following performance parameters:

- the ability to remove RMA (rosin mildly activated), no-clean, and water washable solder pastes from printed circuit board stencils;
- the content of volatile organic compounds (VOC) and halogenated compounds in the cleaning systems; and
- characteristics or conditions from use of this technology which may pose a significant hazard to public health and the environment.

The evaluation consisted of:

- cleaning performance validation through on-site visits of end-users and further validation through additional end-user phone contacts;
- laboratory testing for select VOCs and halogenated compounds by California's SCAQMD using SCAQMD's Clean Air Solvent (CAS) Certification Protocol (CAS Protocol uses SCAQMD Test Method 313 - gas chromatograph/mass spectrometer);
- laboratory testing for metals and pH by DTSC's Hazardous Materials Laboratory using EPA Test Method 6010/7470 and EPA Test Method 9040 respectively;
- toxicological review of laboratory results and aqueous cleaner ingredients to determine if potential hazards to human health or the environment exist; and
- industrial hygiene review of cleaning systems information manual and on-site safety observations.

Details of the evaluation, including data summaries and discussion of results may be found in the report entitled "US EPA Environmental Technology Verification Report, Smart Sonic Aqueous Cleaning Systems, **SMART SONIC**® (EPA/600/R-99/004)."

VERIFICATION OF PERFORMANCE

Performance results of Smart Sonic Corporation's aqueous cleaning systems, Model 2000 and Model 4200, are as follows:

- *Cleaning Efficiency:* In five facilities visited, DTSC's Project Team found no solder paste in stencil apertures when observed at 10X magnification. The size of stencil apertures ranged from 12-50 mil (1 mil=.001 inch). All end-users removed excess solder paste from stencil prior to cleaning in the Smart Sonic aqueous cleaning systems. Cleaning times ranged from 60-90 seconds. Four of the five end-users visited were using a 10% concentration of Smart Sonic's 440-R SMT Detergent (10% concentration recommended by Smart Sonic). The fifth end-user was using a 5% detergent concentration for removing water washable solder paste.

[Additional Information: Eight additional end-users contacted via phone were satisfied with the Smart Sonic stencil cleaning systems and stated that the systems clean consistently and as good, if not better, than the previously used cleaning systems. Previously used systems included CFC-113, 1,1,1-TCA and IPA. Alcohol and wipes were the most commonly used cleaning method.]

- *VOC Content:* The 440-R SMT Detergent does not contain VOCs or halogenated compounds at a detection limit of 0.01% (v/v) using the SCAQMD's CAS Certification Protocol.
- *Metals Content:* Metals analyses conducted by DTSC's Hazardous Materials Laboratory indicate that samples of Smart Sonic's 440-R SMT Detergent concentrate showed no hazardous metals above method detection limits.
- *pH Measurement:* pH measurements conducted by DTSC's Hazardous Materials Laboratory indicates a 440-R SMT Detergent concentrate pH of 13. pH measurements conducted by DTSC's Project Team during on-site visits (using pH indicator paper with pH range 0-14) showed cleaning bath pH of 11 when using 10% 440-R SMT Detergent concentration.
- *Worker Health and Safety:* While using Smart Sonic Aqueous Cleaning Systems, Model 2000 and 4200, end-users should follow Smart Sonic's recommended safety practices as outlined in the User's Manual and 440-R SMT Detergent Material Safety Data Sheet (MSDS). The only significant toxicity associated with the 440-R SMT Detergent concentrate is acute toxicity due to its highly alkaline nature. DTSC's Industrial Hygienist recommends end-users have an eye wash station and an MSDS available within close proximity to the cleaning systems.

Results of the verification show that the Smart Sonic ultrasonic aqueous cleaning systems, Model 2000 and 4200, are capable of removing RMA (rosin mildly activated), no-clean, and water washable solder pastes from printed circuit board stencils such that no solder paste remains in stencil apertures at 10X magnification, provided that end-users follow Smart Sonic's cleaning guidelines. The Model 2000 and 4200 cleaning systems do not contain select volatile organic compounds and halogenated compounds above detection limit of 0.01% (v/v) using SCAQMD's CAS Certification Protocol (April 1997). End-users should follow Smart Sonic's operational and safety guidelines.

End-users should contact their stencil manufacturer prior to changing their cleaning process. Changing from solvents to aqueous cleaning systems may require stencil modifications to make the cleaning system and stencil compatible. In addition, the end-user should contact his/her local, state, or federal regulatory authority regarding management of spent hazardous wastes generated from use of the Smart Sonic aqueous cleaning systems (i.e., spent cleaning baths, rinse baths, and solids containing lead).

Original Signed By
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2/19/99

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Office of Research and Development
United States Environmental
Protection Agency

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James T. Allen, Ph.D., Chief Date
Office of Pollution Prevention
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California Environmental Protection Agency

NOTICE: Verifications are based on an evaluation of technology performance under specific, predetermined criteria and the appropriate quality assurance procedures. EPA and Cal/EPA make no expressed or implied warranties as to the performance of the technology. The end-user is solely responsible for complying with any and all applicable federal, state, and local requirements.

Availability of Verification Statement and Report

Copies of the public Verification Statement (EPA/600/R-99/004VS) and Verification Report (EPA/600/R-99/004) are available from the following:

(Note: Appendices are not included in the Verification Report.
Appendices are available from DTSC upon request.)

1. US EPA / NSCEP

P.O. Box 42419
Cincinnati, Ohio 45242-2419

Web site: <http://www.epa.gov/etv/library.htm> (*electronic copy*)
<http://www.epa.gov/ncepihom/> (*order hard copy*)

2. Department of Toxic Substances Control

Office of Pollution Prevention and
Technology Development
P.O. Box 806
Sacramento, California 95812-0806

Web site: <http://www.dtsc.ca.gov/sppt/opptd/etv/txppetvp.htm>
or <http://www.epa.gov/etv> (*click on partners*)